

## Description of Tribes of the Subfamily Achilinae (Homoptera, Achilidae) and Revision of Their Composition\*

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**Abstract.** Detailed characteristics of the recently described tribes of Achilinae are given and their composition revised. A cladogram of the supposed phyletic relationship of the tribes is presented, as are also 28 figures of anatomical details.

**Key words.** Homoptera; Achilidae Achilinae; systematics; phylogeny.

In my previous study (Yemel'yanov, 1991) a key was provided to the tribes of the subfamily Achilinae that included a number of new tribes but did not contain their detailed description and actual composition. This article is devoted to that task. A complete revision of the family would be a complicated and an enormous task since the genitalia of most representatives remain unstudied: Their structural features, scale of differences, and importance in the taxonomy and phylogeny have not been worked out. In this article primary attention is given to traditional external morphological characters, in particular, wing structure.

The largest and at the same time very natural tribe Plectoderini is virtually unchanged: The genus *Tropiphlepsia* Muir has been removed from its composition. The subfamily Apatesoninae was found to be highly polymorphic and had to be broken down into a number of tribes, the direct relatedness of which is not obvious. The limits of the tribes Myconini and Achilini are reexamined; it is demonstrated that part of the Myconini and the entire tribe Elidipterini should be merged with the Achilini.

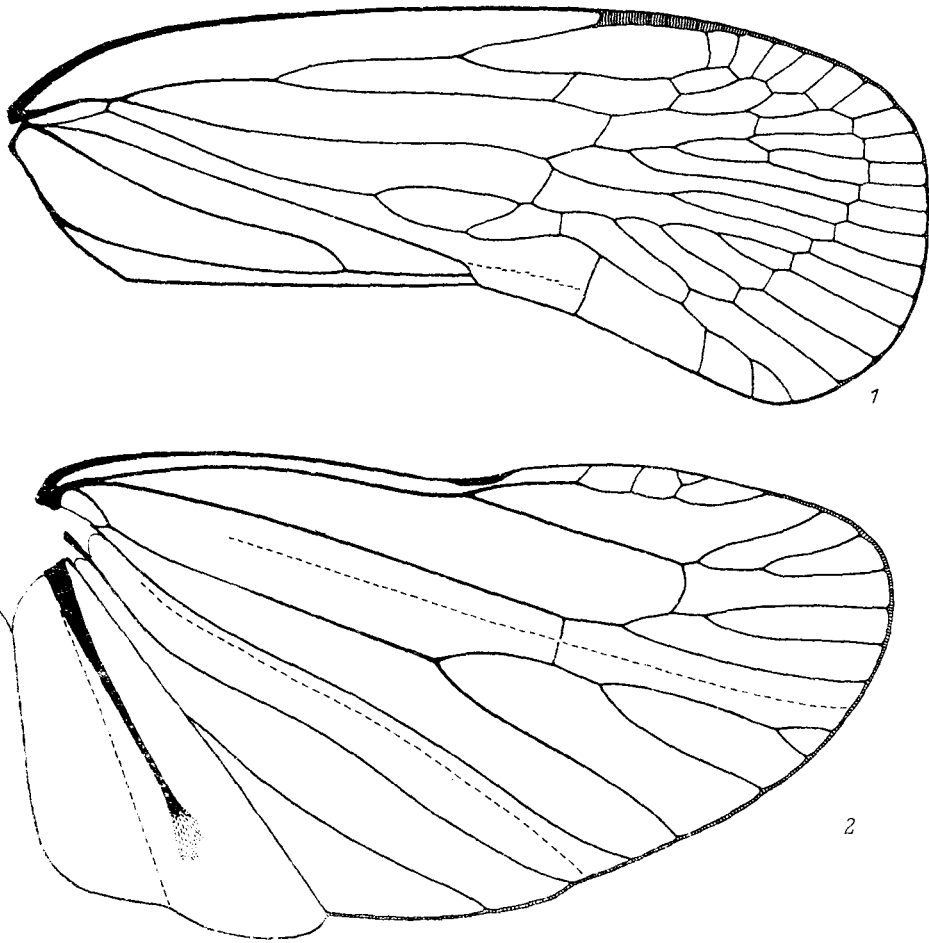
### MYCONITES Fennah, 1950

### MYCONINI Fennah, 1950

Dorsoventrally flattened, produced forms externally resembling *Cixidia* Fieb. (= *Epiptera* Metc.), especially *C. confinis* Zett. and *C. maroccana* Anufr. of Achilini. Head small, eyes relatively large, width of vertex equal to eye diameter. Vertex with distinct carina, slightly wider than long, anterior margin bluntly protruding, lateral margins moderately diverging posteriorly, posterior margin bluntly concave, median carina distinct. Frons flat, dorsally slightly curved back toward vertex and visible as narrow band anterior to it in dorsal view. Frons from dorsum to level of ventral margin of eyes slightly expanded, below expanded more sharply, here lateral margins outwardly arcuate, concavely connecting with upper part. Median carina weak. Clypeus trapeziform, jutting into frons (but two lines continuing oblique parts of clypeal junction running until meeting on frons). Postclypeus with distinct lateral and weak median carinae, lora sloped and visible along sides of clypeus in frontal view. Anteclypeus without continuation of lateral carinae of postclypeus, tectate, without shelf anterior to upper lip. Eyes

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Figs. 1, 2. *Myconus conspersinervis* Stål: 1) forewing; 2) hindwing.

rounded, peocular and supraocular areas narrow, ocelli large, occupying entire width of space from lateral carina of frons to eye. 2nd antennal segment cylindrical, length 1.5 times diameter. Rostrum rather long, as long as head, extending to posterior margin of hindcoxae. Pronotum wide, relatively long, lateral parts posterior to eyes approximately 1.5 times as long as transverse eye diameter. Dorsum of pronotum weakly convex, disc clearly not rising above sides of dorsum. Disc somewhat wider than vertex and considerably narrower than sides of dorsum (each individually), pentagonal, bluntly protruding anteriorly, lateral margins delimited by carina only at anterior margin, further on without distinct junction. Sides of dorsum laterally delimited by distinct carina, below which with same distinct parallel carina. Posterior margin of dorsum gently slopingly obtusely concave in middle. Mesonotum wide, flattened, with 3 longitudinal carinae, lateral ones slightly diverging posteriorly. Tegulae without carinae. **Forewings** (Fig. 1) produced, in middle parallel, membrane taking up almost half length of wing, basal part of coStål margin moderately convex, costal field only slightly wider than others. Stalk of ScRM short, ScRA<sub>1</sub> strongly truncate, continuing almost straight stalk of ScR. RA<sub>2</sub> ([posterostigmal vein) apically with 3 branches, between which crossvein sets off characteristic cell. RP 3-branched, connected with RA by 2 crossveins posterior to branching RA<sub>2</sub>. Media 6-branched, order of branching variable. CuA 4-branched, anterior branch dividing before posterior branch. Marginal cubital cell of

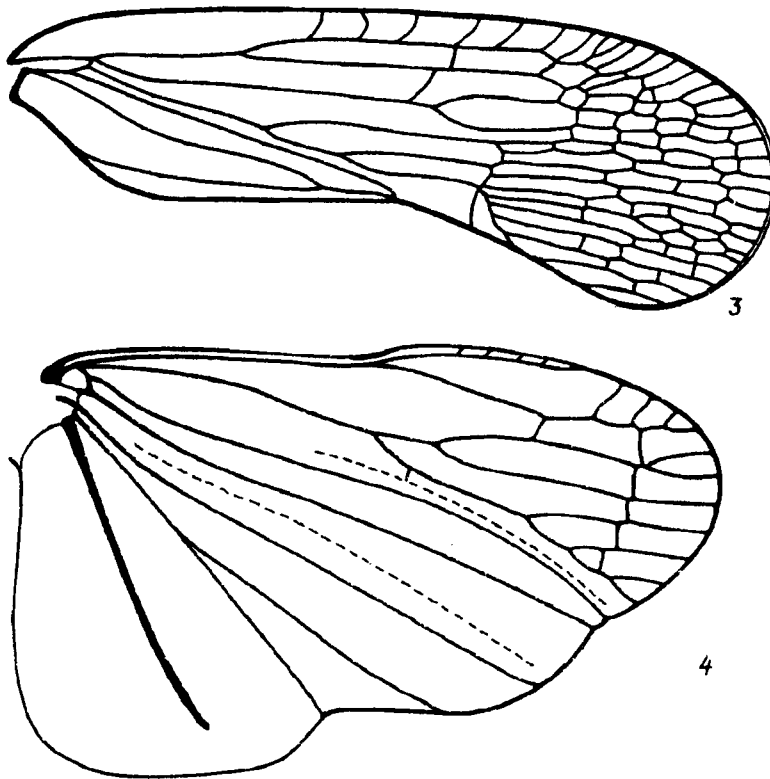
membrane, in addition to principal crossvein, with 2 accessories in distal part after branching of  $CuA_2$  and  $CuA_{2b}$ . Crossveins of subapical row running like steps uninterruptedly from  $MA_1$  to  $CuA_2$ , moving away from terminal margin. Nodal veins  $rm$  and  $mcu$  present as well as a small number of accessories  $ir$ ,  $rm$ ,  $im$ ,  $mcu$ ; sometimes oblique vein  $icua$  in the nodal series developing. Claval fork in posterior quarter of clavus. On **hindwing** (Fig. 2)  $ScRA$  with crossveins (2-3) partially branching (1 on each wing).  $RP$  3-branched,  $ir$  vein not always developed. Media 3-branched, branching in form of posterior rake.  $CuA$  with 3 or 4 tips, branching in form of posterior rake. Medial and postcubital folds well defined, former intersecting  $mcu$  and running along middle of field, latter closer to postcubital stalk.  $A_2$  simple, wide, running into marginal third of anijugal field as in Plectoderini. Legs moderately well proportioned. Hindtibiae with 3 lateral teeth, including femoritibial, apically bearing 6-7 teeth (1+5, 1+6 or 1+2+3 and 1+2+4). 1st segment of hindtarsi with 7-8 teeth, 2nd with 11, on both segments with subapical setae on all except marginal teeth.

The tribe includes the genera *Myconus* Stål and *Myconellus* Fenn., and perhaps *Myrcophenges* Fenn. (Fennah, 1965), described as belonging to the Dictyopharidae but having an achilid clavus and late branching of the media on the forewings. The genera *Epiptera* Metc. and *Neomenocria* Fenn. are junior synonyms of the genus *Cixidia* Fieb., of the tribe Achilini.

### RHOTALINI Fennah, 1950

The tribe includes a single genus *Rhotala* Walker, 1957. Its description is provided below, based on the literature and material referred to the species *Rhotala nawae* Mats.

**Externally similar** to *Cixidia*. Vertex in posterior view deeply parabolically arched, becoming long furrowlike occiput sloping down and back and concealed by the pronotal disc. The place where vertex passes into frons smoothly calluslike, vertex with 2 longitudinal impressions separated by a thick median carina. Frons flat, together with postclypeus making dorsally truncate rhomboid figure; greatest width of frons at level of antennae, tapering below toward clypeus. Frontoclypeal junction straight, distinct. Upper part of frons with oblique intermediate carinae. Median carina of frons and clypeus well developed, without lateral carinae on anteclypeus continuing well-developed postclypeal carinae. Antennae with isodiametric 1st segment, 2nd segment somewhat thicker and twice as long. Eyes rounded, with deep narrow notch ventrally; notch convex, extending over faceted surface of eye. Ocelli large, barely smaller than diameter of antennal fovea of occiput, lying almost touching lateral frontal carina and margin of eyes. Rostrum long, extending beyond hindtrochanters when legs folded; base of distal segment lying near middle coxae. Pronotum with highly elevated disc strongly protruding forward and hanging over truncate occiput-like parabolic awning. Lateral carina of dorsum of pronotum distinct; no horizontal carinae on sides of pronotum. Scutellum with 3 distinct carinae. **Forewings** (Fig. 3). General outlines typical of the family. Membrane more or less symmetrically rounded. Venation polymerized in region of membrane, crossveins in irregular rustication.  $R$  and  $M$  set off from basal cell.  $R$  branches (soon) approximately opposite middle of clavus,  $RA$  with prenodal accessory branches in costal field.  $RP$  apically giving off anteriorly a number of branches (about 4-5).  $M$  branching at level of tip of clavus and not branching further; only short terminal forks may be present.  $CuA$  in prenodal region 3-branched anteriorly like rake, branching opposite distal 1/3 of clavus. Anterior branch of  $CuA$  not branching further. 2 posterior branches of  $CuA$  connected by nodal crossvein continuing back along wing margin (characteristic achilid vein), after which branch successively taking up posterior half of membrane. Posterior branch of  $CuA$ , after nodal crossvein, running diagonally into posterior wing margin (into peripheral vein) and, fusing with it, giving off 2 oblique branches anteriorly. This is the most characteristic feature of the genus and tribe. Claval veins approximated in distal quarter.  $R+RP$  and  $A_1+(Pcu+A_1)$  strengthened by carina. Characteristic oblique crossvein in postradial field anterior to branching of  $M$ . In my specimen of *R. nawae* there is a crossvein  $mcu$  on corium.

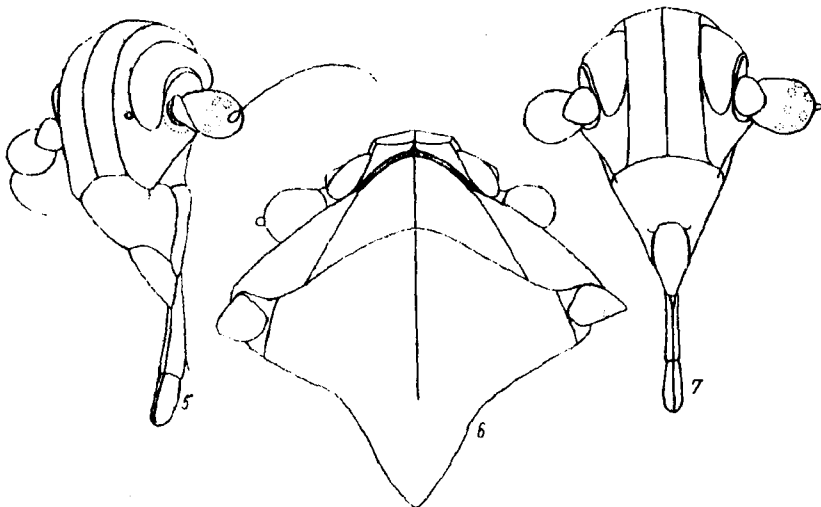


Figs. 3, 4. *Rhotala nawae* Mats: 3) forewing; 4) hindwing.  
After Ishihara (1954) with changes.

**Hindwing** (Fig. 4). Crossveins in costal field posterior to coupling. Anterior rake of branches on *RP* at apex (3-4 branches). Branches of *CuA* intercepted by *M* in region of nodal crossvein. Crossveins on membrane on branches after *RP* and up to branches of *CuA*. Tips of posterior branch of *CuA* and unbranched *CuP* approximated, tips extending to obtuse notch of wing margin. Early diversion of *A*<sub>1</sub> from anal fold almost in basal 1/3. Simple *A*<sub>2</sub> not distinctly extending to wing margin. Legs simple, rather long. Hindtibiae with 6-7 lateral teeth, including femoritibial. Tip of tibia with 5 long teeth (2+3, 3 teeth in outer group, 2 in inner group). Hindtarsi with rather long 1st segment, 5 teeth without subapical setae on tip, 4 teeth on 2nd segment, and 2 inner teeth with subapical setae. 7th sternite of ♀ large, concealing entire ovipositor with broadly apically truncate process.

#### MYCARINI Emeljanov, 1991

Relatively well proportioned, stout, weakly dorsoventrally flattened in thoracic region. Head with sharply delimited vertex. Pronotum not shortened, with arrowlike disc and 2 lateral carinae. Lateral carinae of frons running into postclypeus and distinctly fusing like pointed wedge in upper 1/3. Forewing with membrane taking up no more than 1/3 of wing length. Media usually 4-branched, *MA* branching at nodal level and *MP* branching subapically, more rarely 3-branched when *MP* not branching. *CuA* sometimes with 2-branched anterior branch, but posterior branch of *CuA* consistently 1-branched, posterior cubital cell wide, with one crossvein, no accessory crossveins between nodal line and subapical row. On clavus late fusion of *Pcu* and *A*<sub>1</sub> characteristic, usually only in the distal 1/4.



Figs. 5-7. *Amphignoma corybas* Em.: 5) head in oblique anterior view from left side; 6) anterior part of body, dorsal view; 7) head, anteroventral view.

Usually 3 lateral teeth on hindtibiae, including femoritibial, more rarely 2, but then tooth on basal 1/3 absent and femoritibial preserved. Ovipositor of ♀ concealed ventrally by large truncate 2-branched process of 7th sternite. ♂ not known. Structure of **hindwings** approximately same as in Plectoderini, except that basal cell oblique and tall, medial fold retaining nominal position to tip.

At the present (low) level of study it is clear that the tribe most likely tends toward those perhaps more primitive tribes in which there is a femoritibial tooth on the hindtibiae (Myconini and Rhotalini). Based on the unbranched posterior vein of  $CuA_1$  delimiting the marginal cubital cell, however, it is close to the Plectoderini, which it resembles externally.

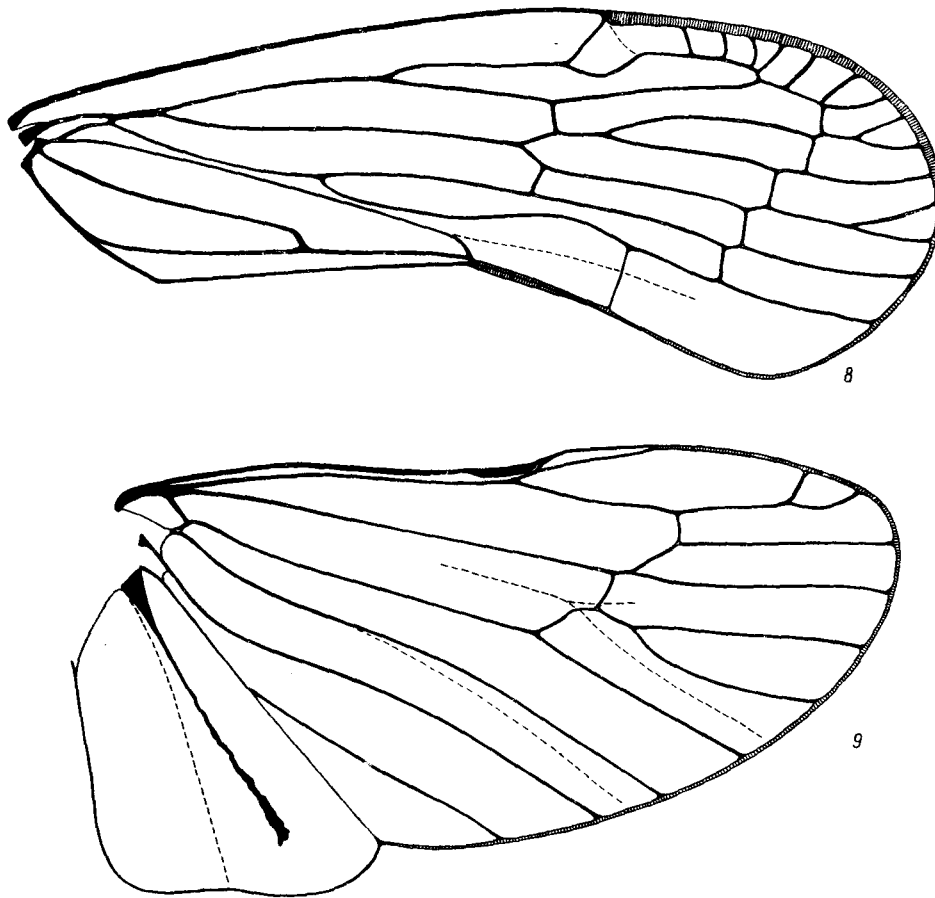
#### AMPHIGNOMINI Emeljanov, 1991

The tribe comprises 1 genus, *Amphignoma* Emeljanov, 1991.

Most unique characteristics of tribe: genae with subantennal carinae, with broad postclypeus indistinctly set off from lora by narrow frons, mesonotum with median carina (lateral carinae completely absent) (Figs. 5-7), hindtibia with 2 lateral teeth, including femoritibial, hindtarsi with teeth without subapical setae, both pairs of wings with nodal fracture, hindwings with arculus but without basal cell and with unique uninterrupted line of veins generally running across wing in nodal region and including crossveins and sections of longitudinal veins from nodus to fork of  $CuA$ .

#### PLECTODERINI Fennah, 1950

This is a very broad and distinctly delimited tribe despite the great diversity of its representatives. Inasmuch as the composition and characteristics of the tribe are not being revised (only the genus *Tropiphlepsia* Muir is being removed), I am providing only a brief diagnosis.



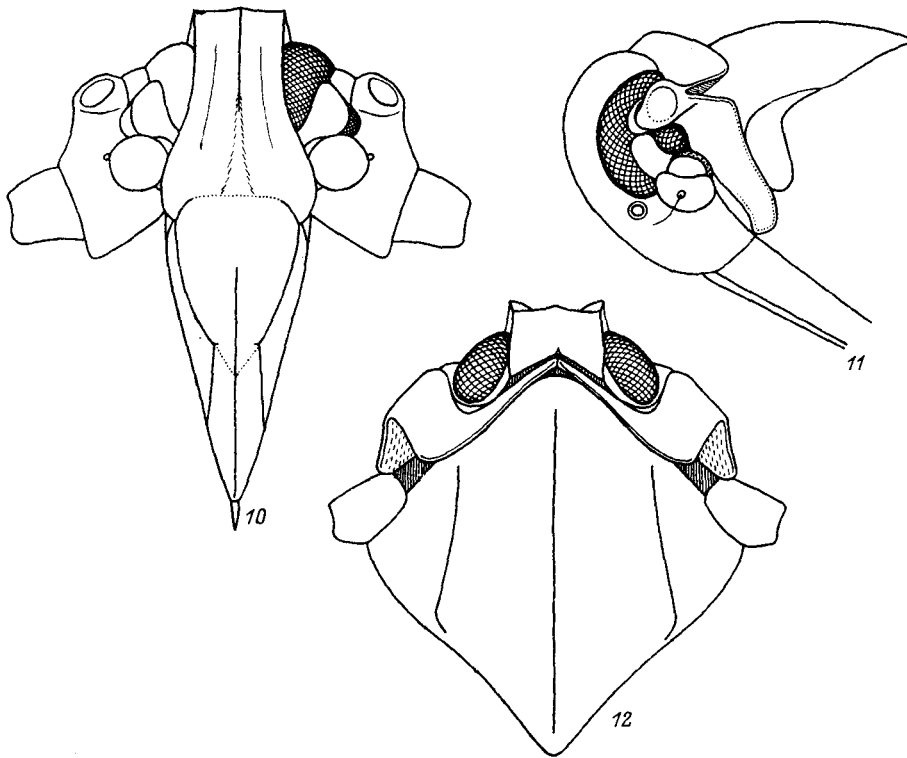
Figs. 8, 9. *Kosalya flavostrigata* Dist.: 8) forewing; 9) hindwing.

Well proportioned, extended, moderately dorsoventrally flattened or almost not at all, cylindrical with wings flat or closely fitting at rest. 3-branched media and 2-branched *CuA* on forewings characteristic (Fig. 8). Hindwings (Fig. 9) characterized by median fold running into the intercubital (*icua*) anterior to the nodal crossvein *mcu* and a short section of the costal field distad of the retinaculum. On hindtibiae only 1 lateral tooth in the basal half of the tibia is characteristically present.

#### BREDDINIOLINI Fennah, 1950

The description is based primarily on the holotype *Breddiniola collaris* Haglund, 1899 (Figs. 10-14), specimen without abdomen.

Body shape close to cylindrical-fusiform, but somewhat dorsoventrally flattened, forewings held tightly fitting. Head (Figs. 10-12) narrow, vertex wider than transverse eye diameter, width close to length along lateral margins, anterior margin slightly obtusely convex, lateral margins somewhat approximated anteriorly, posterior margin deeply obtusely emarginate, surface concave, without distinct median carina but with traces at posterior margin. Frons in lateral view arcuately protruding, more sharply arcuate in upper half, virtually without break passing into vertex. Frons to level of lower eye



Figs. 10-12. *Breddiniola collaris* Hagl., anterior part of body:  
 10) anterior view; 11) lateral view; 12) dorsal view.

margin parallel-sided, this section occupying half total length and about 1.5 times as long as wide, smoothly expanding below eyes and then, becoming arched, tapering to clypeus. Lateral carinae high, on epiclypeal lobes almost foliate, median carina distinct, but disappearing anterior to clypeus. Postclypeus running into frons in form of arch, but actual junction in middle almost lacking. Postclypeus long, a little shorter than frons, cuneately prolonged with distinct lateral carinae, median carina in upper half entirely smooth, distinct in lower half. Anteclypeus tectate, with median carina, lateral carinae of postclypeus, weakening, continuing on to it and joining in wedge in middle. Rostrum long, extending far beyond hindtrochanters, ultimate segment 0.33 as long as penultimate, tip of penultimate almost extending to trochanteral condyles of hindcoxae. Eyes bifurcated. Main part of eye narrow, prolonged vertically, reniform in profile. Posterior margin of head in region of eye with deep notch narrowly rounded anteriorly into which projection of lateral margin of pronotum tightly fits as if into groove. Notch cutting through eye to anterior margin of supraantennal nonfaceted sinus and, delimiting it thus from above, entirely cutting off posteroventral part of eye, transforming it into a small second pair of eyes. Ocelli large, approximated to eyes. Antenna small, with ovoid rounded 2nd segment resting on strongly beveled distal margin of 1st segment, in which lower wall is extremely shortened and upper wall elongated, concealing part of 2nd segment. Pronotum (Figs. 10, 11) in dorsal view narrow with subparallel anterior and posterior margins, surface turned to slant forward and upward, bearing narrow median carina; lateral margin of dorsum shortened because of deep posterior notch and shaped like a craterlike recess, anterior part fitting into above-mentioned notch of posterior margin of head in region of eye. Outer wall of notch formed by margin of paranotal lobe, latter rather extended

with tegulae posterior to it; anterior to tegulae, because of notch, with cavity delimited externally by inner wall of paranotal lobe and internally by lateral part of mesoscutum. Junction of pronotum and head, bifurcation of eye, recess, and notch on pronotum unique to Breddiniolini. Dorsum of mesonotum in outline almost square, lateral carinae slightly arching outwardly and approximated more posteriorly than anteriorly. **Forewings** rather wide, membrane taking up approximately 1/2 total length of wing, anterior margin uniformly convex, posterior margin weakly obtusely concave, terminal margin roundedly truncate. Narrow precostal field developing wider at base and narrower in distal part. Costal vein arching back before nodus to meet *ScRA*<sub>1</sub> branch, latter slopingly approaching wing margin here, together both basally and posteriorly delimiting well-defined extravenal pterostigma, as in Cixiidae. *ScRA*<sub>1</sub> in form of stout rounded vein distinctly extending to peripheral vein, appearing as narrow flat transversely striated band resembling pterostigma in terms of structure. Both branches of radius and media diverging from arculus, *ScRA* splitting opposite middle of costal field, anterior branch (*ScRA*<sub>1</sub>) not branching, posterior (*RA*<sub>2</sub>) splitting subapically, *RP* splitting at level of nodus and not branching further, *RP* higher and cuneate to fork. Media splitting before nodus; both branches splitting again on or barely beyond nodus, and not branching further. Anterior cubitus branching at same level as *ScRA*, not branching further as in Plectoderini. At nodal level with only *mcu*; *RP*<sub>2</sub> and *MA*<sub>1</sub> connected by crossvein somewhat distad of nodus. Subapical row of crossveins completely developed beginning with *ir*, crossveins from *rm* to *icua* forming single line parallel to wing margin; subapical veins all weakened, transversely striated. Postclaval crossvein considerably closer to tip of clavus than to terminal wing margin. Clavus with obliquely truncate tip, claval veins fusing somewhat distad of middle of sutural margin of clavus. Wing of genus *Breddiniola* or a genus close to it illustrated by Dworakowska (1988) in Fig. 39 (p. 73) identified as belonging to the family. **Hindwing** with a structure and outline typical of family. Basal cell obliquely extended, arculus long, *ScR* and *M* diverging from basal cell on common stalk. *ScRA* posterior to retinaculum running more than halfway to wing tip, *RP* 2-branched, fork long; media also 2-branched, branching at same level as *RP*; anterior cubitus 3-branched, making 1st branch approximately at nodus, 2nd from anterior branch as in previous veins *M* and *RP*. Median fold splitting in two and posterior branch cutting off *CuA*<sub>1</sub> from *CuA*<sub>2</sub> at base (in Plectoderini *CuA*<sub>2</sub> cut off from *CuA*<sub>3</sub>). Postcubital fold present. *A*<sub>1</sub> diverging from jugal fold without branching, in distal 2/3 fold not accompanied by vein. *A*<sub>2</sub>, becoming thinner, extending to wing margin. Legs moderately proportioned, hindtibiae about twice as long as femora, bearing 3 lateral teeth, but femoritibial tooth absent, 7 teeth apically, outer tooth much longer than others, latter forming single oblique row. 7 teeth without subapical setae, at tip of 1st segment of hindtarsus; 7 with slender subapical setae at tip of 2nd segment.

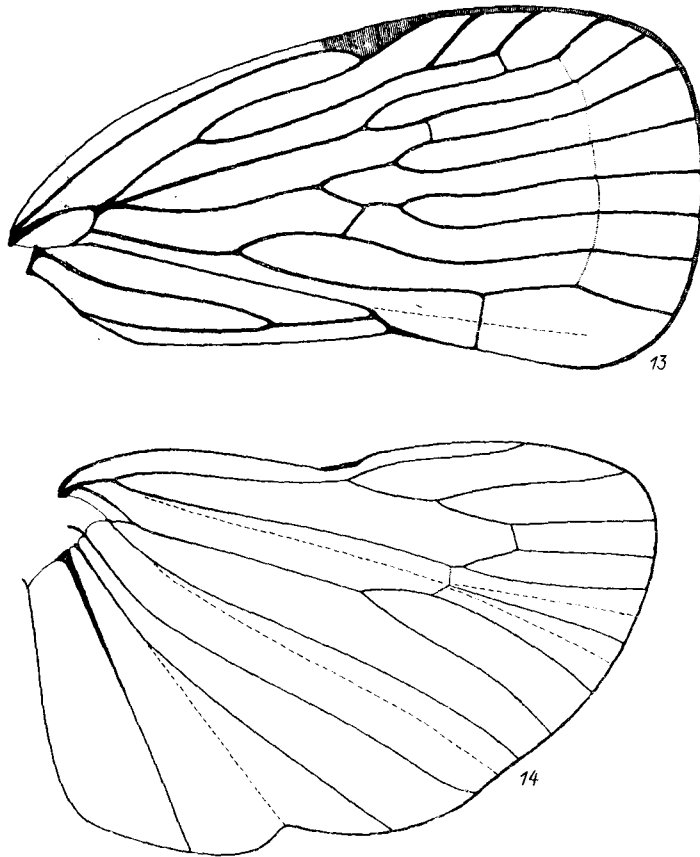
#### APATESONITES Metcalf, 1938

#### ILVINI Emeljanov, 1991

The tribe comprises only 1 genus, *Ilva* Stål, 1866.

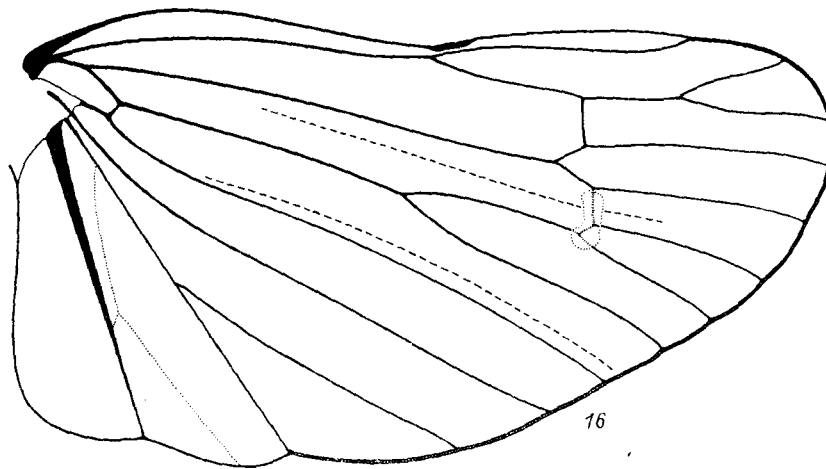
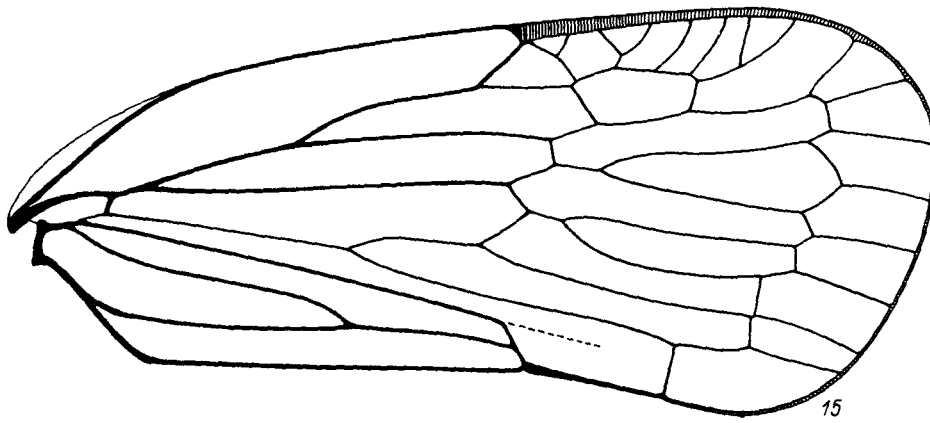
Moderately laterally compressed with wings tectate at rest and membranes slightly overlapping. Head markedly narrower than pronotum. Vertex transverse, moderately inclined forward, with weakly convex anterior margin and more strongly concave posterior margin, and with lateral margins markedly diverging posteriorly; median carina weak, conspicuous only in posterior half of vertex. Triangular areas indistinctly set off from frons. Frons slightly inclined posteriorly, with clypeus forming gently sloping concave furrow, lateral carinae foliate, median carina weakly defined in lower 2/3, in upper 1/3 turning into indistinct groove; lateral margins slightly diverging ventrally, weakly convex in lower part. Clypeus jutting bluntly into frons, with lateral carinae converging cuneately about 1/3 distance from tip of anteclypeus; wide and flat indistinctly defined median carina on postclypeus, on anteclypeus median carina pronounced only from tip to point of connection of lateral carinae, narrow and distinct. Frons more than twice as long as wide. Supraocular and preocular fields moderately wide. Eyes small,





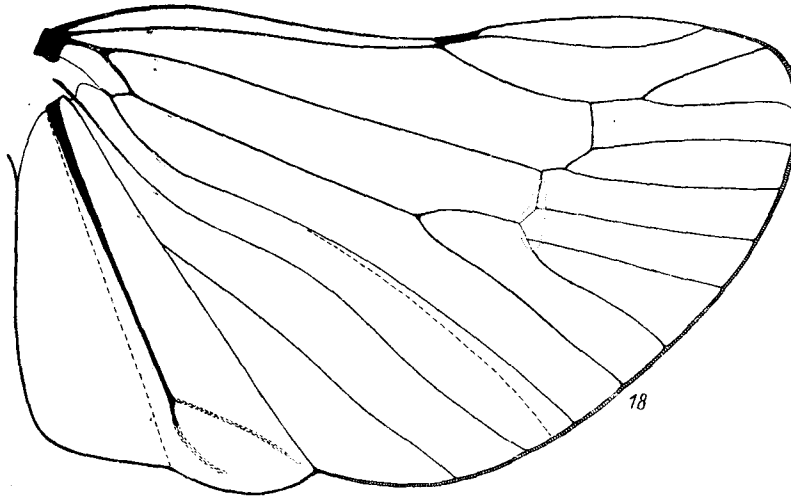
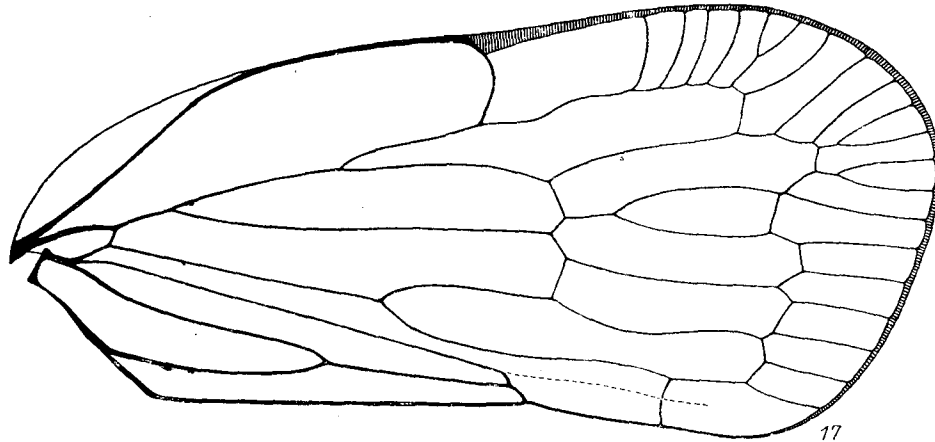
Figs. 13, 14. *Breddiniola collaris* Hagl.: 13) forewing; 14) hindwing.

rounded; ocelli large, with distinct carina running from them to eye, separated by groove from convex margin of antennal fovea of head capsule. Rostrum long, tip of subapical segment extending beyond hindcoxae. Antennae small, with spherical 2nd segment, partially visible anteriorly along side of frons, antennae directed obliquely downward (and not upward, as Fennah writes). Pronotum moderately elongate, lateral to eyes width about  $2/3$  eye diameter. Pronotal disc along midline a little longer than vertex, anterior margin straight, lateral margins convex, diverging posteriorly and parallel, running into posterior margin, posterior margin of pronotum distinctly obtusely ( $120^\circ$ ) emarginate, median carina of disc distinct, like lateral ones, markedly smooth before posterior margin. Sides of dorsum separated from paranota by oblique carina continuing postocular carinae. On sides of dorsum and on paranota flat granulations visible at location of larval sensory pits. Mesonotum long, in profile more or less straight with 3 carinae, lateral carinae in anterior part somewhat diverging posteriorly, parallel in posterior part; lateral lobes rather sharply ( $90^\circ$ ) turned downward. Tegulae without carinae. **Forewings** (Fig. 15) in middle moderately expanding, apically obliquely rounded. Costal margin in basal part opposite basal cell and *ScRM* stalk more sharply arcuate, with rudimentary cuneate precostal field, width of precostal carina greatest opposite middle of basal cell, opposite arculus costal field more than 3 times width of precostal field. *ScRM* stalk shorter than basal cell. Stigmal cell with 3-4 crossveins. Costal field with distinct oblique blind branch coming off radial stalk. *RP* branching subapically. Media 4-branched, both primary branches splitting at nodal level just distad of *rm* and *mcu* veins. *CuA* 2-



Figs. 15, 16. *Ilva nigrosignata*, Stål: 15) forewing; 16) hindwing.

branched, branches reaching terminal margin. Crossvein of marginal field transverse. Subapical row of crossveins running from *ir* to *icua*, row stepped, only veins *mcu* and *icua* forming continuous line. Nodal row including veins *rm*, *mcu* and indistinct *ir*, 2nd *ir* distinct, lying in middle of membrane. Clavus rather flat, all fields approximately equally wide. **Hindwings** (Fig. 16) with *RP* 2-branched, *M* 3-branched (posterior branch appears to be common with *CuA*), and *CuA* 2-branched. Median fold not distinct, running into posterior branch of *M* at point where *mcu* vein approaches it, base of posterior branch of *M* and *mcu* vein weakened in order to facilitate bending of wing; distad, fold cannot be reliably traced. Instead of usual posterior cubital fold, unusual anterior cubital fold developed. *AS*<sub>2</sub> flat, straight, tapering apically, not extending to wing margin, weak branch coming off *A*<sub>1</sub> near base to anijugal lobe, smoothly approaching *A*<sub>2</sub> before middle and then moving away before margin; at closest point, giving off oblique branch connecting with *A*<sub>2</sub>. Legs of average proportions, fore- and mid-femora and tibiae slightly flattened and expanded. Hindtibiae with 1 lateral tooth in distal 1/3, apically with 8-9 teeth (1+8, 1+7), tibiae more than twice as long as femora. Tibia with 1st segment bearing 8, 2nd segment 10 teeth apically; teeth of 2nd segment, except marginal ones, with subapical setae.



Figs. 17, 18. *Sevia moerens*, Stål: 17) forewing; 18) hindwing.

**SEVIINI** Emeljanov, 1991

The tribe includes only 1 genus, *Sevia* Stål, 1866 (= *Ateson*, Metc., 1938).

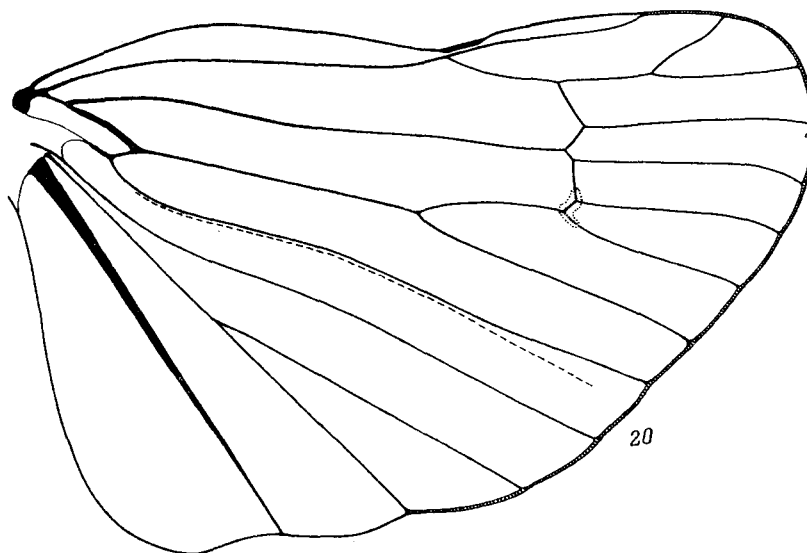
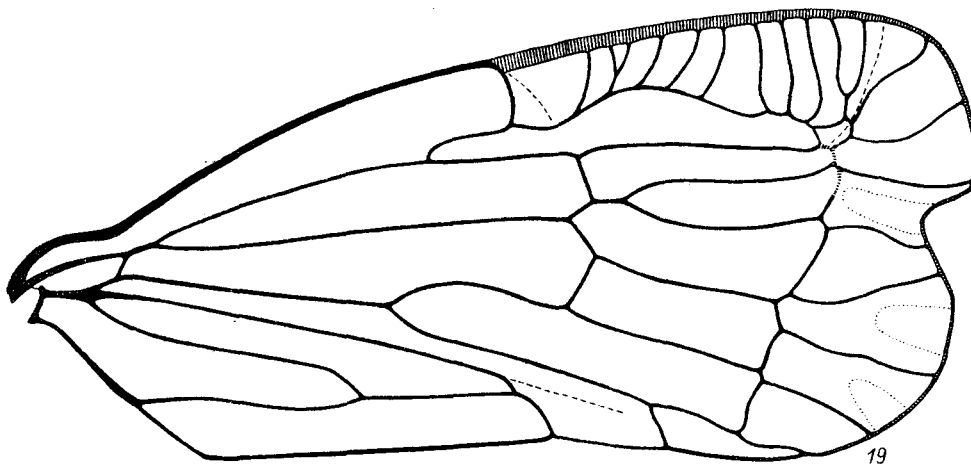
Moderately laterally compressed with wings held tectately at rest, wing membranes slightly overlapping. Head markedly narrower than pronotum. Vertex moderately inclined forward, transverse, with straight anterior and concave posterior margins, no median carina. Frons vertical, together with clypeus slopingly furrowlike concave, lateral carinae foliate. Median carina weak, often visible only at upper margin. Clypeus forming indistinct obtuse junction with frons. In upper part lateral carinae of frons more or less straight, slightly diverging, below level of antennae convexly arcuate and ventrally slightly convergent toward clypeus. Length of frons approximately twice width. Nearly straight carinae of clypeus, continuing lateral carinae of frons and converging on anteclypeus at acute angle, turning into longitudinal carina of apical part, beveled toward upper lip. Supraocular and preocular fields

moderately wide. Eyes not large, rounded, ocelli large, with weak transverse ventral carina visible. Lateral impressions of head smooth, beginning dorsally in preocular field; no shelf below ocelli, but low slender carina. Rostrum slightly shorter than frons, extending markedly past hindcoxae, tip of 2nd segment lying above posterior margin of hindcoxae. Antennae not large, with spherical 2nd segment, partially visible frontally laterad of frons. Pronotum short, with short disc, and with straight anterior and deeply emarginate posterior margins and with lateral carinae smoothly diverging posteriorly and outwardly and gradually merging with posterior margin posterior to eyes, median carina distinct. Sides of pronotum separated from dorsum by distinct oblique carina. Posterior margin of sides of pronotal dorsum parallel to posterior margin of supraocular carinae and eyes, and bent laterally, freeing spot for tegulae. Mesonotum long, with 3 longitudinal carinae, lateral lobes strongly obliquely diverging downward, anterior part of disc convex, dropping down anteriorly. Tegulae without carinae. **Forewings** (Fig. 17) expanding to rounding of distal part of membrane. Costal margin in basal part arched more steeply, but due to expanded precostal carina, costal vein here concave, delimiting lanceolate precostal field and then extending to wing margin. Width of precostal field opposite arculus approximately equal to width of costal field. Stalk of *ScRM* not longer than basal cell. Stigmal cell with many crossveins. In prenodal part of costal field several blindly terminating crossveins present or forming indistinct network. *RP* subapically 2-4-branched in form of anterior rake. *Media* with 5-7 apical branches with predominant branching forming posterior rake. *CuA* 2-branched, sometimes with 3rd intercalary; crossvein of marginal field of *CuA* straight. Branches of *CuA* extending to terminal wing margin. Subapical row of crossveins from *ir* to *icua* uneven, continuous, nodal row including only *rm* and *mcu*. Vein *ir* posterior to distal part of stigma. Clavus rather flat, sutural field a little narrower than others. **Hindwings** (Fig. 18) with *RP* 2-branched, *M* 2-branched (sometimes 3-branched), *CuA* 4-5-branched, anterior branch branching. Median fold not distinct, but veins near nodal *mcu* weakened in order to flex wing. Vein *A*<sub>2</sub> in premarginal part weakening, giving off 2-3 branches diverging toward *A*<sub>1</sub>. Legs of moderate proportions. Hindtibiae with 1 lateral tooth in distal 1/3, apically with 7 teeth (1+6 or 1+1+5), tibiae not more than twice as long as femora. 1st and 2nd segments of hindtarsi with 8-10 teeth, sometimes fewer on 2nd segment, but teeth, except for marginal ones, always with subapical setae. Median carina of abdominal tergites not distinct.

#### APATESONINI Metcalf, 1938

The tribe includes the single monotypic genus *Apateson* Fowler, 1990.

Distinctly laterally compressed, sides of pronotal dorsum virtually vertical, wings held acutely tectate at rest, membranes of forewings entirely vertically contiguous. Head not wider than pronotum, eyes along sides overlying pronotum and almost extending to posterior margin. Vertex short, X-shaped, transverse, narrowed in middle and expanding laterally, steeply inclined forward, with distinct median carina. Frons vertical, with clypeus slopingly furrowlike concave, median carina very weakly defined, junction with clypeus also weakly defined, forming obtuse, nearly right angle with frons. Lateral margins of frons from vertex to level of antennae straight, slightly diverging, below slightly convex, ventrally somewhat convergent. Length of frons along outer margins not more than 1.5 times width. Nearly straight clypeal carinae continuing lateral carinae of frons, converging at acute angle toward tip of anteclypeus, latter almost linearly truncate and taper of lateral walls ending in carina connecting tip of lateral carinae and base of upper lip. Supraocular and preocular fields not wide, former wider than latter, eyes not large, rounded, ocelli large. Cheeks strongly depressed below eyes, separated from preocular field by carina delimiting shelf of depression. Lateral carinae of frons and clypeus, because of depression of cheeks, appear as foliate crests. Rostrum absent in my specimen. Antennae not large, with spherical 2nd segment, not visible frontally. Pronotum short, disc narrower than vertex, posterior margin deeply parabolically emarginate. Median carina weakened, short, lateral carinae of disc diverging posteriorly and fusing with posterior margin at width of vertex. Arcuate



Figs. 19, 20. *Apateson albomaculatum* Fowl.: 19) forewing; 20) hindwing.

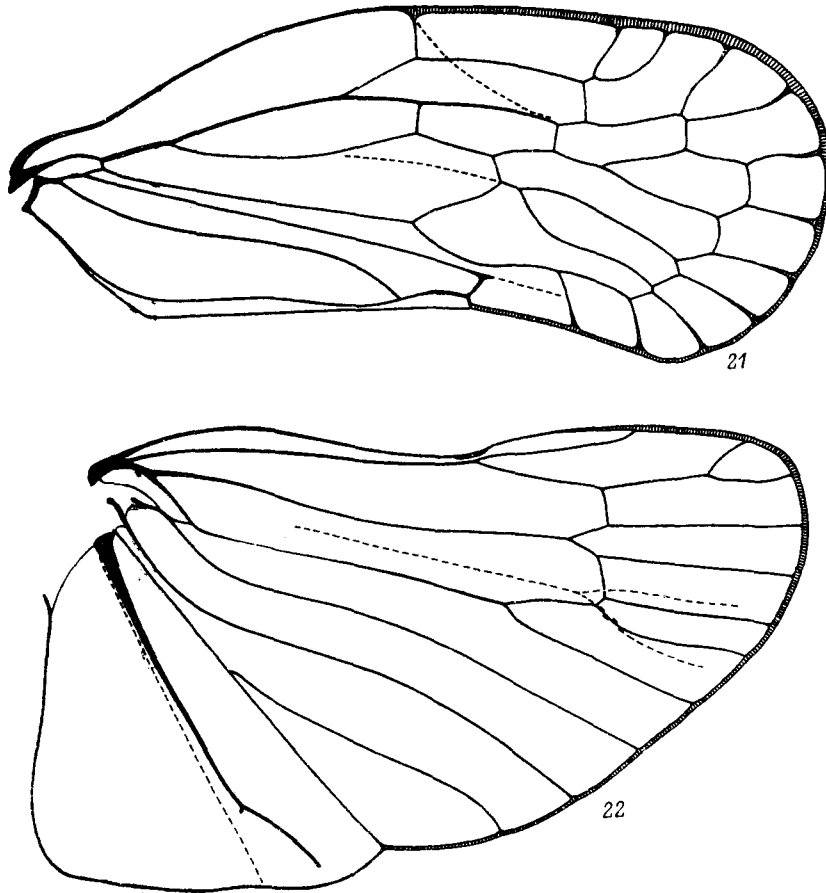
vertical posterior margins of sides of pronotal dorsum run parallel to posterior margins of supraocular field and eyes a small distance from them. Sides of pronotum without carinae and not separated from sides of dorsum by border. Mesonotum long, with 3 distinct longitudinal carinae, lateral lobes virtually vertical, lateral carinae of disc slightly arcuate, convex, in middle part disc somewhat wider than vertex. Tegulae without carinae. **Forewings** (Fig. 19) expanding from base to terminal 1/3 of membrane, terminal margin with distinct notch between 1st and 2nd median veins, costal margin subbasally concave; in posterior half of membrane in terminal 1/3 on cells with 3 thickened depressions between 2nd and 4th branches of media and in postmedian field. Clavus flat with equally wide fields, entirely obliquely vertical at rest. Stalk of *ScRM* less than basal cell in length. Stigmal cell with undulatory *RA* and many crossveins. *RP* 2-branched. Media 4-branched, *MA* branching immediately past nodal level, *MP* subapically. *CuA* 2-branched, both branches running into posterior margin of membrane, crossvein

of marginal field of *CuA* oblique. Subapical row of crossveins from *ir* to *mcu* pronounced in all cells, *rm* and *mcu* present at nodal level. Tip of clavus beveled. Veins appearing rounded in cross-section except for cuneate *R-RP* and *A<sub>1</sub>-Pcu+A<sub>1</sub>*, but these veins weakly defined. **Hindwings** (Fig. 20) with *RP* 2-branched, *CuA* 3-branched, and with crossveins *rm* and *mcu* at nodal level. Veins membranous at fork of anterior branch of *CuA*. Vein *A<sub>2</sub>* straight, simple, extending to wing margin. Legs moderately proportioned. Hindtibiae with 1 lateral tooth in apical 1/3, with 7 teeth apically (1+6). 1st and 2nd segments of hindtarsi with 6 teeth, 2nd segment bearing subapical setae on all except marginal teeth. Abdominal tergites with dorsal carina.

### TROPIPHLEPSIINI Emeljanov, 1991

The tribe includes 1 genus *Tropiphlepsia* Muir, 1924 (1 species *T. badia* Muir, 1924 described from 1 ♀ from Brisbane, Queensland, Australia), which Fennah (1950) in his monograph on Achilidae mistakenly referred to the Plectoderini, evidently based on a partially preserved specimen. Fennah, just as Muir, did not indicate in particular that the wings are held steeply tectate (the membranes are virtually vertical, touching each other) and that the hindtibiae have 1 lateral tooth near middle. Both of these characters are typical of Apatesonini sensu Fennah and not of Plectoderini. In Fennah's drawing the nodal crossvein *rm* is absent, but it is present in Muir's and in my specimen.

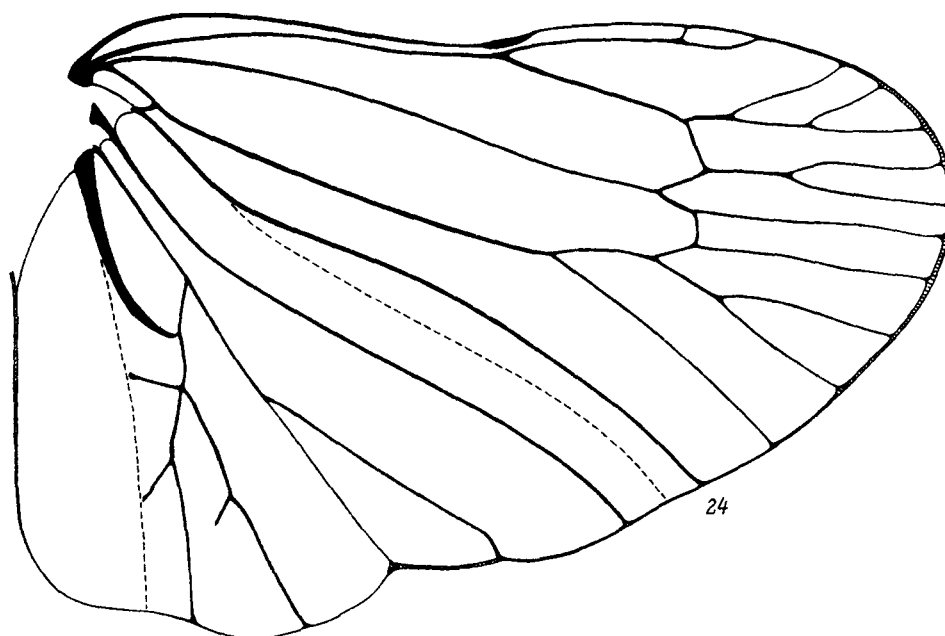
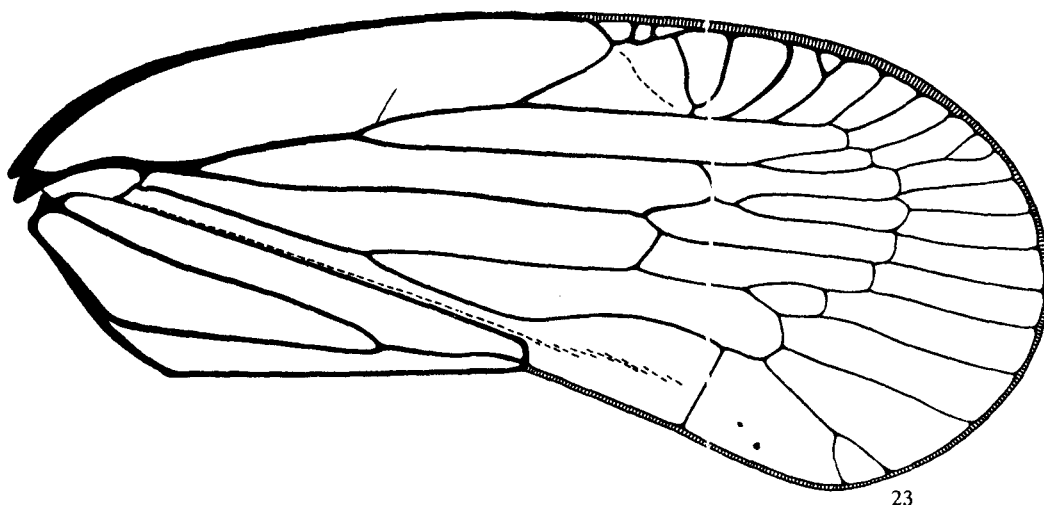
External appearance closely resembling representatives of the Cixiidae with wings steeply tectate as in, for example, *Ptoleria* Stål. Head not wider than pronotum, eyes along sides overlying pronotum, almost extending to posterior margin. Vertex short, transverse, anterior margin distinct, almost straight, if viewed frontally, only barely distinctly obtusely convex, lateral margins markedly diverging posteriorly, resembling high carinae, posterior margin of vertex concave, but almost straight in middle, parallel to anterior edge. Posterior corners of vertex drawn posteriorly and thus markedly longer laterally than in middle. Surface of vertex slightly concave, median carina resembling weak, slender protruding line. Frons rather flat, slightly longer than wide, lateral margins convex, carinate, greatest width of frons below middle, upper margin weakly concave, junction with clypeus approximately linearly concave, but in middle 1/3 indistinct. Distinct median carina, no intermediate carinae. Postclypeus cuneate, with distinct lateral carinae and with median carina running through upper part between epiclypeal lobes of frons. Lateral carinae of postclypeus with concave fracture, passing into anteclypeus and converging at apex at acute angle. Vertex and frons in lateral view converging at obtuse angle, frons vertical, vertex inclining forward. Supraocular and preocular fields not wide, eyes not large, ocelli large. Cheeks below ocelli depressed, small antennae with rounded 2nd segment concealed behind lateral carinae of frons and, below, ocelli become foliate forming anterior wall of antennal fovea. Antennae not large, with spherical 2nd segment not visible frontally. Rostrum short, directed almost vertically downward, length of clypeus approximately as great as protruding part of rostrum. Pronotum short, shorter than vertex, with broad disc and linear sides of dorsum posterior to eyes. Anterior margin of disc straight, posterior obtusely concave, median carina short, distinct. Anterolateral carinae forming a smooth continuous arc with postocular carinae as in Cixiidae and running below eyes, fusing with posterior margin. Mesonotum with 3 subparallel carinae and lateral lobes steeply beveled downward. Lobes barely wider than head between inner margins of tegulae. Tegulae facing dorsally and forwardly, lying below eyes lateral to paranotal lobes in frontal view. **Forewings** (Fig. 21) expanding toward tip of clavus, with subbasal convexity on costal margin, with sharp bend on clavus along vein *A<sub>1</sub>* and its continuation *Pcu+A<sub>1</sub>*. Membrane not shorter than long and with rather uniformly rounded margin. Subcostiradius and media after basal cell forming rather long common stalk. Stigmal cell long, in distal part with 1-2 crossveins. Stigmal cell not cixioid, not formed, as in the Cixiidae, by expansion of crimped wing margin but rather a typical cell with same consistency as others. *RP* 2-branched. Posterior branch of media, immediately after separating from *MA*, anastomosing briefly with anterior branch of *CuA* for which latter bends forward, delimiting broad cell with narrow distal part. Media 4-branched, *MA*



Figs. 21, 22. *Tropiphlepsia* sp.: 21) forewing; 22) hindwing.

forking near nodal line, *MP* subapically. *CuA* 2-branched, posterior tip of clavus after *CuA*<sub>2</sub> with oblique crossvein. Crossveins on membrane forming subapical row beginning with vein *rm*, *ir* moved proximally and lying anterior to tip of 3rd stigmal cell; also a nodal vein *rm*. Tip of clavus concavely cut, vein *Pcu+A*<sub>1</sub> running into corner of this transverse tip. Veins of corium and clavus distinctly carinate, in places ridged on dark elements of markings. Most conspicuous of such ridges on vein *CuA*<sub>2</sub> opposite tip of clavus and on clavus in middle of free vein *A*<sub>1</sub> and in middle of common stalk *Pcu+A*<sub>1</sub>. **Hindwings** (Fig. 22) with *RP* 2-branched, *CuA* 3-branched, and with crossveins *rm* and *mcu* at nodal level. Median fold splitting before nodal crossveins, posterior branch after vein *mcu* first running along *CuA*<sub>1</sub> and then out to first cubital field. Cubital fold absent. Vein *A*<sub>2</sub> not far from margin bending obtusely forward slightly, breaking off near wing margin without reaching it; at place of bend with projection resembling strongly shortened branch. Posterior lobe of anijugal lobe markedly expanded. Legs short. Hindtibiae also short, 1.33 times as long as femora, bearing 1 lateral tooth in middle and 8 apical teeth (2+6). 1st and 2nd segments of hindtarsi with 11 teeth apically; all except for marginal teeth bearing subapical platelets (thick, noncolored blunt-ended setae).

The distinctive feature of the genus, and thus the entire tribe, is the anastomosis of *MP* with *CuA*<sub>2</sub> on the forewings.



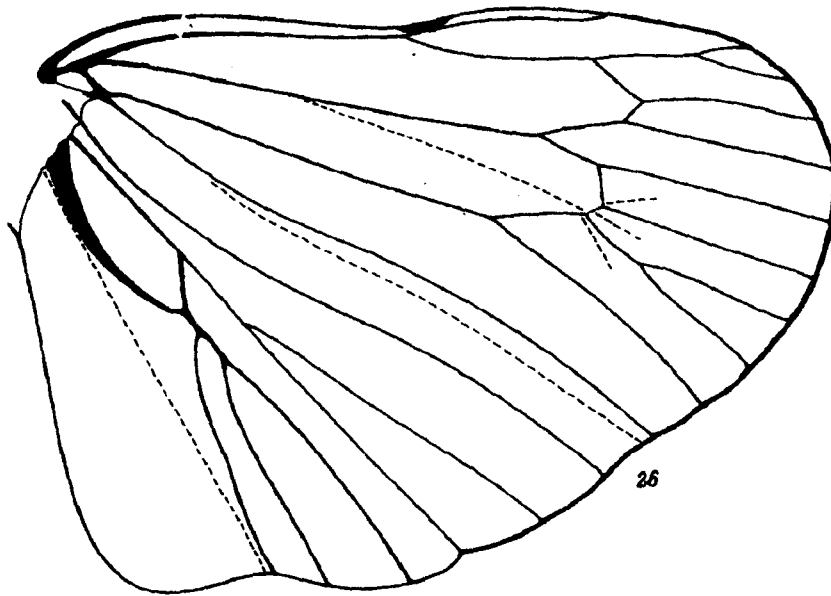
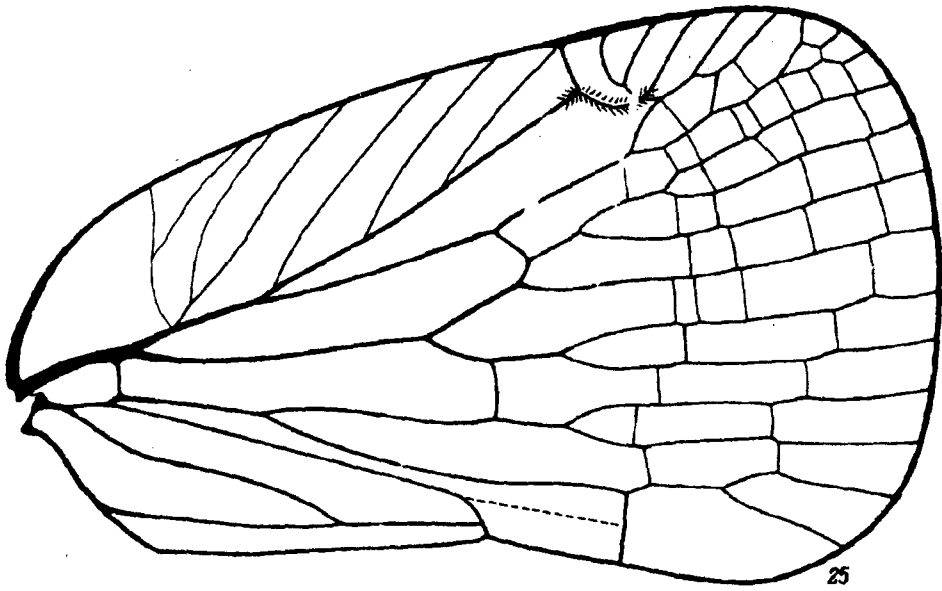
Figs. 23, 24. *Achilus flammeus* Kirby: 23) forewing; 24) hindwing.

#### ACHILITES Stål. 1866

#### ACHILINI Stål. 1866 (= Elidipterini Fennah, 1950)

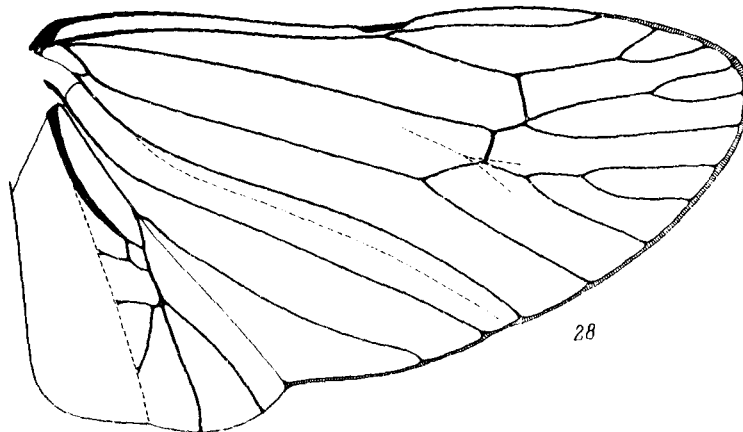
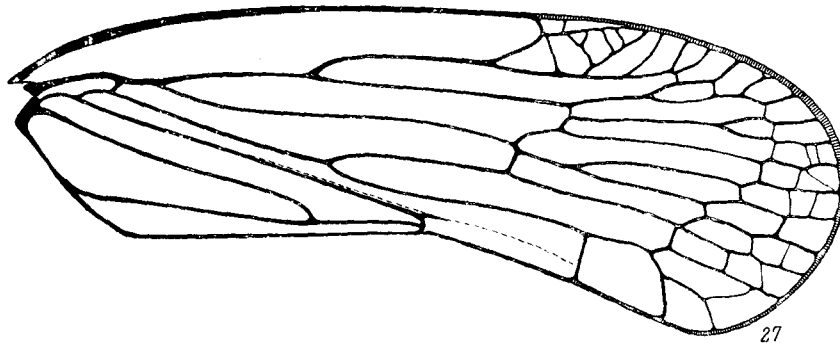
Medium-sized and large representatives of family. Head not large, not broad, junction of vertex with frons more often indistinct or smooth, but sometimes distinct, in profile may form acute angle. Frons more or less prolonged, parallel-sided or nearly so. Pronotum comparatively large, considerably wider than head, disc usually markedly raised and at least in anterior half laterally delimited by





Figs. 25, 26. *Flatachilus diffinis* Walk.: 25) forewing; 26) hindwing.

carinae. **Forewings** (Figs. 23, 25, 27) held slopingly tectate, broad, with expanded costal field and with costal margin arcuately convex in basal part. Distad of basal cell veins *ScR* and *M* on common stalk for short distance. In costal field oblique recurrent secondary (false) veins or simple crossveins sometimes developed. In stigmal region numerous crossveins characteristic. *Media* usually 4-5-branched. Both branches of anterior cubitus usually bifurcate apically, more rarely only posterior branch. **Hindwings** (Figs. 24, 26, 28) sometimes with apical branching of *RA*, *RP* 2-3-branched, *M* 3-branched, *CuA* 4-



Figs. 27, 28. *Cixidia lapponica* Zett.: 27) forewing; 28) hindwing.

branched. Extremely characteristic in posterior branch of  $A_1$ , extending to anijugal lobe and anastomosing with  $A_2$ , after which 2-3 veins run along the anterior anijugal field, often with blind branching. Hindtibiae with 1 lateral tooth in distal 1/3. Tarsi with subapical setae on 2nd segment and sometimes on 1st.

As already mentioned, the tribe is characterized by the special anastomosis of the anal veins on the hindwings (Figs. 24, 26, 28). This character was not considered by Fennah, and this evidently resulted in his mistaken referral of *Cixidia* to the Myconini and *Neomenocria* (junior synonym of *Cixidia*) to the Elidipterini. The anastomosis, based on the drawings or collection materials, is present in the genera *Achilus* Kirby, *Elidiptera* Spin., *Faventilla* Metc., *Catonidia* Uhl., *Booneta* Dist., *Nelidia* Stål, *Flatachilus* Fenn., *Phradmonicus* Em., and *Cixidia* Fieb. (= *Epiptera* Metc., *Neomenocria* Fenn.). Of the genera assigned to Achilini, this character is not elucidated in *Aneipo* Kirk., *Bunduica* Jacobi, and *Mabira* Fenn. An anomalous anastomosis of the anal veins is also characteristic of the recently established tribe Achillini. Typical representatives of Elidipterini, as understood by Fennah, are characterized by a disorganized venation on the membrane, deformation of its flatness, and the presence of rounded pigmented protruding eyespots (*Elidiptera* Spin., *Messeis* Stål, *Paraphradmon* Fenn., *Prinoessa* Fenn., *Metaphradmon* Fenn.). However, the genera *Paralidiptera* Fenn. and *Phradmonicus* Em. are clearly closely related to the preceding ones, have a flat membrane, lack the eyespots, and keep the regular course of the veins. Fennah (1950) did not provide clear characters for the Elidipterini that would separate it from Achilini. Still, the name taken from the genus *Elidiptera* may be preserved for the subtribe

that includes the overwhelming portion of the genera of the tribe with the exception of *Achilus*, *Cixidia*, and perhaps some others, the status of which is still undetermined (*Bunduica*, *Aneipo*, *Mabira*).

#### KEY TO SUBTRIBES OF ACHILINI

- 1(2). No blind branches in anal system of hindwings, posterior branch of *A* reaching wing margin at same place as 2nd anal fold (Fig. 26). ..... Elidipterina Fennah.
- 2(1). Blind branches in anal system of hindwings, posterior branch of *A* reaching wing margin far from 2nd anal fold.
- 3(4). Anterior branch of  $A_1$  on hindwings diverging from 1st anal wing fold considerably distad of posterior branch (Fig. 24). No median fold. Subapical setae present only on 2nd segment of hindtarsi. .... Achilina Stål.
- 4(3). Anterior and posterior branches of  $A_1$  on hindwings diverging from 1st anal fold approximately at same point (Fig. 28). Median fold present. Subapical setae on 1st and 2nd segments of hindtarsi. .... Cixidiina **subtrib. n.**

#### ACHILLINI Emeljanov, 1991

The tribe includes 1 genus—*Achilla* Haglund, 1899.

Head strongly overlying sides of pronotal dorsum. Frons with distinct median carina. Carinae of postclypeus, continuing onto anteclypeus, converging in middle at acute angle. Pronotum not large, narrow, short; mesonotum large, long, with steeply inclined lateral lobes. Wings (see Fig. in: Yemel'yanov, 1991) held almost steeply tectate, membranes somewhat approximated, postclaval regions overlying one another. Forewings with narrow precostal field, radius branching near basal cell, media many-branched, oblique vein diverging from  $CuA_2$  at tip and crossing marginal cubital field of membrane, with late fusing claval veins. Legs with 1 lateral tooth on hindtibiae in apical 1/3. Hindwings with anastomosis of anal veins as in Achilini, but with posterior branch intersecting 2nd anal fold. Rostrum exceptionally short, with apical segment shorter than diameter.

#### RELATIONSHIPS OF THE TRIBES

The origination of the characteristic structure of the membranes in the family, which is associated with the fact they overlie one another at rest, can be imagined only when the wings are held flat or gently slopingly tectate, or rather tightly fitting. The apically truncated clavus with the continuation of the claval fold and its axis in the posterior part of the membrane allows the wings to fit closely to the body and the membranes to touch arcuately boxlike along the longitudinal axis. Thus, the more or less flat positioning of the wings at rest should be considered plesiomorphic. In the structure of the hindwings the nonelongate basal cell, nominal running of the median fold in its entirety, and simple second anal vein not reaching the apex may be considered plesiomorphic. In the structure of the legs a complete set of lateral teeth on the hindtibiae, including the femoritibial and 2 median teeth, is obviously plesiomorphic.!

The group of the least advanced tribes includes the Myconini, Mycarini, and, with reservations, Rhotalini (Fig. 29, numbers in text and diagram represent the discussed apomorphies). If we consider the polymerization of the veins a primitive character, then the Myconini will occupy the lowest position in the Achilinae tree. Based on abundant polymerization of the anterior cubital branch of the

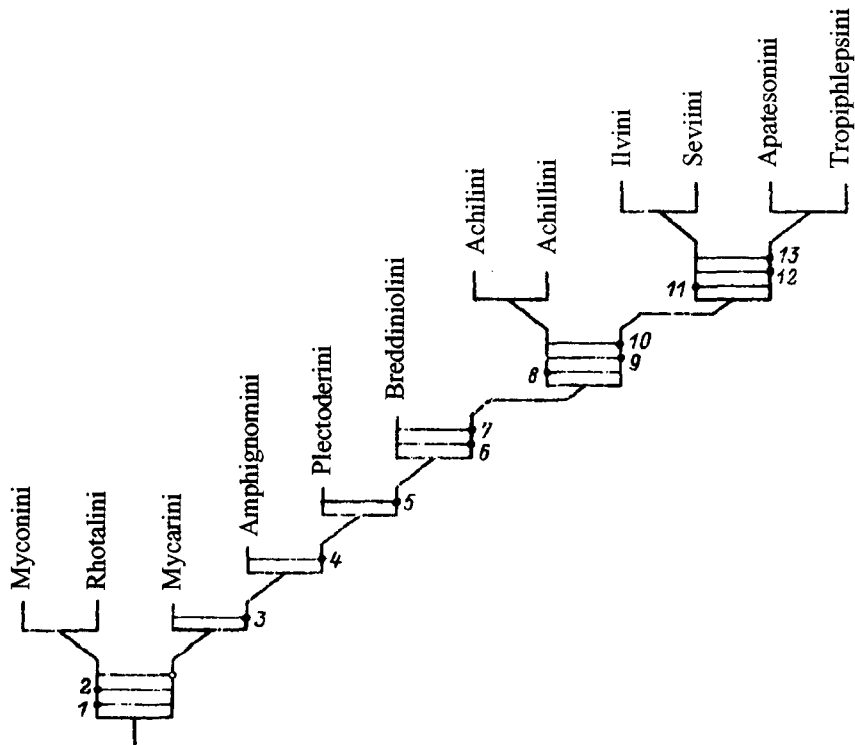


Fig. 29. Cladogram of presumed relationships of the tribes of the subfamily Achilinae. Explanation of numbers in text.

forewings, the Rhotalini (1) are close to them. These two tribes are also characterized by the presence of an interradial crossvein in the nodal series (2). The Mycarini in turn are very close to the Plectoderini, but in the latter, as in all following tribes, the femoritibial tooth of the hindtibiae (4) has disappeared and the anterior cubital branch of the median fold (3) appeared. The anterior cubital branch of the median fold is found as well in the original Amphignomini, but in them the femoritibial tooth is still preserved; the combination of these characters makes it possible to place the Amphignomini between Mycarini and Plectoderini. Between the advanced tribes characterized by an expanded costal field (6) and preservation of only 1 lateral tooth on the hindtibia apically shifted (7), after the Plectoderini, in which the only tooth is approximated to the base, the tribe Breddiniolini, with 3 lateral teeth but without the femoritibial one, is placed. Further demarcation occurred between tribes with an anomalous anastomosis of the anal veins (8) that fold the wings flatly as before (Achilini and Achillini) and the group of tribes folding wings tectately (9). The latter group is united as well by the unique structure of the basal cell of the hindwings (10)—obliquely produced with an entirely independent divergence of the median stalk from it. Of the 4 tribes that hold the wings tectate, 2 (Seviini and Ilvini) keep the membranes overlying and they are united by the presence of a precostal field in the basal part of the wing (11), and 2 tribes (Tropiphlepsiini and Apatesonini) have changed the position of the membranes; in them they touch along the inner surfaces and do not overlie (12), and they have acquired at the base a notch in the costal margin of the wing (13) so that when they jump the tips of the hindfemora pass below the costal margins and not on the inside as before.

For many of the tribes in the family the collection material is exceedingly poor, often with just 1-2 specimens of a single sex. Thus, for example, ♂ are still not known for the tribes Mycarini,

Amphignomini, and Tropiphlepsini. There is very little biological data for the tribes Achilini and Plectoderini; therefore, nothing definitive may be said regarding the adaptive value of morphological evolutionary transformations.

Fennah considered representatives of the Plectoderini the least advanced of the achilids, but did not make a convincing case for this (Fennah, 1950: 4, 13). It is possible that the reason for this assertion was the great similarity between some Derbidae (*Goneokarella* Fennah, *Vinata* Dist.) and the Plectoderini, about which Fennah (1952) wrote in a survey of the Derbidae. Here he transferred the genus *Phrygia* Stål from the Achilidae to the Derbidae, without, however, making clear which characters impelled him to do this. If Fennah is correct in assigning the genera *Goneokarella* and *Phrygia* (as well as *Vinata*) to the Derbidae, then there is a contradiction between the secondary (as in the Achilidae) structure of the clavus and the secondary fusion of the anal tube and phallobase (as in the Derbidae). Fennah believed that *Goneokarella* and *Phrygia* acquired the structure of the clavus, as in the Achilidae, from the condition, as in *Vekunta* Dist., in which the claval vein still runs into the margin of the clavus ( $sA_2$ ) and not its tip. In that case the Achilidae could have derived from the Derbidae of the *Goneokarella* group, but that postulates a reversion of the fusion of the phallobase and anal tube. Assuming repeated origination of the achilid clavus is also difficult to allow.

In my phylogeny of the Achilinae the tribe Plectoderini is in the middle part of the chain of tribes. I believe that the similarity between *Goneokarellini* and Plectoderini results from a combination of reversions and plesiomorphies and on the whole is secondary. It is most likely that the venation of the corium and membrane in *Goneokarella* is plesiomorphic while the structure of the clavus is convergent. In the *Goneokarella* Fennah points to the presence of the femoritibial tooth on the hindtibiae, which is not found in the Plectoderini. The interrelationships of the families Derbidae and Achilidae require careful and comprehensive investigation using the greatest possible number of different characters. Particularly worthy of careful study are genera belonging to the Derbidae but in which the clavus is structured as in the Achilidae (*Vinata*, *Phrygia*, *Goneokarella*). Evidently it is here that *Ipsnola* Sign. also belongs.

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